इंटरनेट मानक

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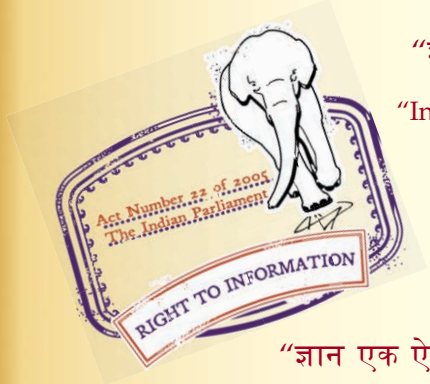
IS 6304 (1992): Stationary batteries lead-acid type with pasted positive plates [ETD 11: Secondary Cells and Batteries]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 6304 - 1992
(Reaffirmed 2002)

भारतीय मानक

पेस्ट किए गए अचूक प्लेटों वाली सीमा अम्ल प्रकार की स्थायी बैटरियाँ – विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

STATIONARY BATTERIES — LEAD-ACID TYPE – WITH PASTED POSITIVE PLATES — SPECIFICATION

(Second Revision)

First Reprint FEBRUARY 2008
(Including Amendment No. 1)

UDC 621.335.2

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110 002

March 1992

Price Group 3

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

This revision is to up-date the standard and bring it in line with latest practices and includes some more capacity ratings of the batteries.

This standard was first published in 1980. In the first revision the standard was updated to bring in line with the latest practices, and the stationary cell capacities were rationalized to 19 standard capacities used by the Indian Posts and Telegraphs Department.

The cells covered by this specification may have pasted positive plates using either pure lead low antimonial lead-alloy or lead-calcium positive grids. The modern practice in the construction of stationary cells using pasted positive plates is to employ double separation with a glass-wool retainer mat or any other suitable material placed against the surface of the positive plates, for good service life.

The endurance test specified in the standard may not be suitable for lead-calcium cells should these be introduced at a later date. The reason is that at a current of $I = 0{\cdot}1 \times C_{10}A$, the voltage of such cells is likely to rise to around 2·9 V, which would be very severe and may yield unrealistic results on this system which is very durable on float duty.

The standard gives the overall dimensions, capacities and performance requirements of stationary cells and batteries of lead-acid type with pasted plates. The tests for performance specified in this standard are to be carried out in ambient conditions. The result of such tests should be corrected to the standard atmospheric conditions, if required.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

AMENDMENT NO. 1 AUGUST 2003
TO
IS 6304 : 1992 STATIONARY BATTERIES — LEAD-ACID TYPE — WITH PASTED POSITIVE PLATES — SPECIFICATION

(Second Revision)

(*Page* 2, *clause* **4.11**, *and Annex* A *on page* 5) —Substitute 'IS 266 : 1993' *for* 'IS 266 : 1977' and 'IS 1069 : 1993 Quality tolerances for water for storage batteries — Specification (*second revision*)' *for* 'IS 1069 : 1964 Water for storage batteries (*revised*)'.

(*Page* 3, *clause* **8.3**) — Insert the following Note at the end:

'NOTE — Digital/Analog meters may be used.'

(*Page* 3, *clause* **8.4.2.2**, *and Annex* A *on page* 5) — Substitute 'IS 8320 : 2000 General requirements and methods of tests for lead-acid storage batteries (*second revision*)' *for* 'IS 8320 : 1982 General requirements and methods of tests for lead-acid storage batteries (*first revision*)'

(*Page* 5, *clause* **8.9.4**, *line* 1) — Substitute '1 500 h' *for* '1 000 h'.

(ET 11)

Printed at Power Printers, New Delhi

Indian Standard

STATIONARY BATTERIES — LEAD-ACID TYPE – WITH PASTED POSITIVE PLATES – SPECIFICATION

(Second Revision)

1 SCOPE

This standard specifies overall dimensions, capacities and performance requirements of stationary cells and batteries using pasted type positive and negative plates.

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjunct to this standard.

3 TERMINOLOGY

3.0 For the purpose of the standard, this definitions given in IS 1885 (Part 8) : 1986 in addition to the following shall apply.

3.1 Type Tests

Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general quality and designs of a given type of batteries.

3.2 Acceptance Tests

Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

3.2.1 *Lot*

All batteries of the same type, design and rating manufactured by the same factory during the same period, using the same process and materials, offered for inspection at a time shall constitute a lot.

4 MATERIALS AND CONSTRUCTION

4.1 General

All materials used in the manufacture of stationary cells and batteries shall be the best of their respective kind, free from flaws and defects and shall conform to the relevant Indian Standards, if any. There shall be no impurities that may be harmful to the performance or life of a cell or battery.

4.2 Containers

Containers shall be made of rubber, suitable plastics material, fibre glass reinforced plastics or lead-lined wood.

4.2.1 Containers made of rubber, fibre reinforced plastic (ERP) or plastics shall conform to IS 1146 : 1981.

NOTE — The requirements for lead-lined wood containers shall be subject to agreement between the user and the manufacturer.

4.3 Cell Lids

Lids used with sealed or closed type cells shall be of rubber, plastics, glass or fibre-glass reinforced plastics and shall be provided with a vent plug. If containers are opaque, there shall be provision for an electrolyte level indicating device on closed or sealed cells.

4.4 Venting Device

The venting device on sealed or closed cells shall be of anti-splash type and shall allow the gases to escape freely but shall effectively prevent acid particles or sprays from coming out. Provision shall be made for drawing electrolyte samples, checking and servicing of the electrolyte.

4.5 Sealing Compound

The sealing compound when used in sealed or closed cells, and if bitumen based, shall conform to IS 3116 : 1965.

4.6 Plates

The plates shall be of pasted construction and of good workmanship. These shall be free-from blow-holes, cracks and other imperfections.

4.7 Separators

The synthetic separators shall conform to IS 6071 : 1986.

4.8 Terminal Posts

Positive and negative terminal posts of cells shall be clearly and unmistakably identifiable.

Terminal posts shall be suitably sealed at the lid to prevent escape of acid spray, by means of rubber grommets or other suitable devices.

4.9 Fasteners

Bolts, nuts and washers for connecting the cells shall be effectively lead-coated to prevent corrosion.

4.10 Connectors

Where it is not possible to bolt the cell terminals directly to assemble a battery, separate lead or lead-coated copper or aluminium connectors of suitable size shall be provided to join the cells. In such cases, the coating shall be adequate and tenacious. In some cases, it may be necessary to correct individual cells in parallel as specified by the purchaser. In such cases, suitable connectors shall be used.

4.11 Electrolyte

The sulphuric acid and water used for preparing electrolyte for the cells shall conform to IS 266 : 1977 and IS 1069 : 1964, respectively.

5 RATING AND DESIGNATION

5.1 Rating

The rating assigned to the cell or battery shall be the capacity expressed in ampere hours (Ah) (after correction to 27°C) stated by the manufacturer to be obtainable when the cell or battery is discharged at the 10-hour rate to an end voltage of 1·85 V per cell.

This rating is known as 10-hour rating of the cell or battery and shall be designated as C10.

5.2 Designation of Cells

Cells shall be designated by the letter 'F' for flat, pasted plates followed by the standard rating of the cell, followed by a letter indicating the type of cell container.

The following will be used to designate container types:

G = Glass
H = Rubber
P = Plastics
W = Lead-lined wood
F = Fibre reinforced plastics

Example:

F 80 W will designate a cell of (flat) pasted positive construction, of capacity 80 Ah at the 10-h rate, in a lead-lined wood container.

6 CAPACITIES AND DIMENSIONS OF CELLS

The capacities and maximum external dimensions of cells shall conform to Table 1. The voltage of each cell shall be 2 V.

7 MARKING

7.1 The following information shall be durably marked on the outside of the cell or battery:

a) Indication of the source of manufacture,
b) Cell designation,
c) Acid level in case of transparent containers,
d) Month and year of manufacture, and
e) Country of origin.

Table 1 Capacities and Maximum Overall Dimensions of 2 V Cells

(*Clause* 6.1)

Capacity at 10-Hour Rate	Maximum Overall Dimensions		
	Length	Width	Height
(1)	(2)	(3)	(4)
Ah	mm	mm	mm
20	105	170	365
40	105	170	365
60	140	170	365
80	165	190	365
100	190	190	450
120	190	190	450
150	190	190	550
200	265	215	550
300	320	215	550
400	380	215	550
500	390	235	550
600	390	235	715
800	515	235	715
1 000	515	300	750
1 500	450	400	865
2 000	500	450	865
2 500	650	450	865
4 000	900	480	1 240
5 000	900	500	1 240
6 000	900	500	1 240
7 000	1 100	500	1 240
8 000	1 100	500	1 240

NOTE — The length and width dimensions of cells given in this table may be interchanged.

7.1.1 The following additional information shall be given on the instruction cards supplied with the cell or the battery:

a) Ampere-hours capacity,

b) Manufacturer's instructions for filling and first charging of the cell/battery together with normal charging instructions,

c) Maintenance instruction, and

d) Designation of the cell/battery in accordance with this standard.

7.1.2 The cells and batteries may also be marked with the Standard Mark.

8 TESTS

8.1 Temperature for Tests

The temperature of electrolyte during the test discharge shall be within 16°C and 38°C.

8.2 Specific Gravity

For the purpose of test requirements, the specific gravity or electrolyte of fully charged cell shall be $1{\cdot}200 \pm 0{\cdot}005$ corrected to 27°C. Temperature correction for hydrometer readings of specific gravity shall be made as follows:

a) For each 1°C above 27°C, 0·000 7 to be added to the observed readings; and

b) For each 1°C below 27°C, 0·000 7 to be subtracted from the observed readings.

8.3 Test Equipment

The voltmeters, ammeters, thermometers and hydrometers used for the tests shall comply with the requirements of **5.2** of IS 8320 : 1982.

8.4 Classification of Tests

8.4.1 *Type Tests*

8.4.1.1 The following shall constitute type tests:

a) Visual examination (**4.3, 4.4, 4.6, 4.8, 4.9 4.10** and **7**);

b) Tests for materials and components (**4.1 4.2, 4.5, 4.7** and **4.11**);

c) Checking of dimensions (**6**);

d) Test for capacity (**8.6**);

e) Test for retention of charge (**8.7**);

f) Ampere-hour and watt-hour efficiency tests (**8.8**);

g) Endurance test (**8.9**); and

h) Test for voltages during discharge (**8.10**)

8.4.1.2 Type tests shall be carried out on three cells. Two cells shall undergo all tests except endurance test while the other would undergo endurance test preceded by a capacity test.

8.4.1.3 If any of the samples fails in the relevant type test, the testing or inspecting authority may call for fresh samples not exceeding twice the original number and subject them again to all the tests or test in which the failure has occurred as agreed to between the manufacturer and the buyer. If there is any failure in any of the retests, the type shall be considered as not having passed the requirements of this standard.

8.4.2 *Acceptance*

8.4.2.1 The following shall constitute the acceptance tests:

a) Visual examination (**4.3, 4.4, 4.6, 4.8, 4.9, 4.10** and **7**);

b) Checking of dimensions (**6**);

c) Test for capacity (**8.6**); and

d) Test for voltages during discharge (**8.10**),

8.4.2.2 A recommended sampling plan and criteria for the acceptance of a lot is given under **11.1.4** of IS 8320 : 1982.

8.5 First Charge

The cell or battery, if received in the dry uncharged condition, shall be filled with the electrolyte and charged in accordance with the manufacturer's instructions.

8.6 Test for Capacity

After, standing on open circuit for not less than 12 h and not more than 18 h (this open circuit stand may be reduced by agreement between the purchaser and the manufacturer) from completion of a full charge, the battery or cell shall be discharged as given under **8.6.1** and **8.6.2**.

8.6.1 The battery shall be discharged through a suitable variable resistance at constant current of $I = 0{\cdot}1$ C10 A. The discharge shall be stopped when the closed circuit voltage across the battery falls to $1{\cdot}85 \times nV$.

NOTE — If however, a test discharge cannot be conductored within the specified rest period due to any exigencies, a freshening charge may be given to the cell/battery at the finishing rate of charge recommended by the manufacturer for a period of 1 hour after every 24 h or part thereof, of extended rest period. The capacity test, however, can be started after a minimum period of two hours elapsing after this freshening charge.

8.6.1.1 The cell shall give not less than 85 percent of its rated capacity after the first cycle. The rated capacity should be obtained within 5 cycles. The cell shall not be subjected to further cycles once the rated capacity has been reached.

8.6.2 During the discharge, voltage, temperature and specific gravity readings shall be taken at hourly intervals. The battery shall be charged at the normal charging rate immediately after discharge.

8.6.3 The capacity in ampere-hours obtained on the discharge shall be corrected to 27°C by applying the temperature correction given in Table 2.

8.6.4 *Requirement*

The period of discharge shall be not less than $10 + 0{\cdot}08\ (t - 27)$. The actual capacity shall be not more than $12 + 0{\cdot}08\ (t - 27)$, t being the test temperature.

8.6.5 *Alternative Rates of Test Discharge*

Test for capacity, by agreement between the purchaser and the supplier, may be carried out at any rate other than 10-h rate. In such cases, the 3-h rate is recommended. Capacities at various rates of discharge and corresponding final voltages are given in Table 2.

Table 2 Capacities and Final Cell Voltages at Various Rates of Discharge at 27°C

(*Clauses* 8.6.3 *and* 8.6.5)

Discharge Rate	Ah-Capacity as Percentage of Standard 10-H Rating	Cell and Voltage	Variation of Capacity per °C
(1)	(2)	(3)	(4)
h	percent	V	percent
1	50	1·75	1·1
2	63·3	1·78	0·98
3	71·7	1·80	0·91
4	78·2	1·81	0·87
5	83·3	1·82	0·84
6	87·9	1·83	0·82
7	91·7	1·83	0·81
8	95	1·84	0·81
9	98	1·84	0·80
10	100	1·85	0·80

8.7 Test for Retention of Charge

8.7.1 A cell or battery which has successfully passed the tests mentioned in **8.6** shall be tested for the loss of capacity on open circuit.

8.7.2 The cell or battery shall be fully recharged at the current specified by the manufacturer and shall then be submitted to two consecutive capacity tests in accordance with **8.6**, the value of the initial capacity C, being calculated as the mean of the two results thus obtained.

8.7.3 After a complete recharge and the cleaning of electrolyte from its surface, the cell or battery shall be left on open circuit for a period of 21 days without disturbance, at a temperature of 27°C ± 2°C.

8.7.4 After the storage period of 21 days, the cell or battery shall be discharged in accordance with **8.6**. The value of capacity measured after storage is denoted by C'.

8.7.5 After the discharge, the cell or battery shall be fully charged at the rate recommended by the manufacturer.

8.7.6 The loss of capacity S expressed as a percentage is calculated from the following formula:

$$S = \frac{C - C'}{C} \times 100$$

8.7.7 *Requirement*

The loss of capacity shall not exceed 10 percent.

8.8 Ampere-Hour and Watt-Hour Efficiency Test

8.8.1 *Ampere-Hour Efficiency Test*

A fully charged cell or battery shall be discharged at $I = 0{\cdot}1 \times C10$ A to an end voltage of $1{\cdot}8 \times nV$, careful measurements being made of the exact number of ampere-hours delivered. On recharge the same number of ampere-hours are put back at the same current. A second discharge shall then be made to the same cut-off voltage as before. The efficiency of the cell or battery is then calculated as the ratio of the ampere-hour delivered during the second discharge to the ampere-hour put in on the charge.

8.8.1.1 The ampere-hour efficiency when calculated as described in **8.8.1** shall be not less than 90 percent.

8.8.2 *Watt-Hour Efficiency*

The watt-hour efficiency shall be calculated by multiplying the ampere-hour efficiency by the ratio of average discharge and recharge voltage. The values of discharge and recharge voltages shall be calculated from the log sheets for ampere-hour efficiency test.

8.8.2.1 The watt-hour efficiency when calculated as described above shall not be less than 75 percent.

8.9 Endurance Test for Cells

8.9.1 The test shall be conducted on one cell which have successfully passed the capacity test specified in **8.6**.

8.9.2 For cells above 500 Ah rating, a test cell may be built up using components similar to those used in the actual cell to restrict the capacity to 500 Ah to ease testing.

8.9.3 The cell or batteries shall be charged at a continuous current of $0{\cdot}1 \times C10A$ at $40 \pm 3°C$ for a total period of 1 500 hours in the following sequence:

One period of 300 h

Two periods of 200 h each

Eight periods of 100 h each

At the end of each of the above periods of continuous charge the cells and batteries shall be tested for the rated capacity according to **7.6** except that the temperature for test shall be $40 \pm 3°C$. No temperature correction for capacity shall be applied.

8.9.4 *Requirement*

The capacity of the cell or battery after 1 000 h and in each of the checking discharges shall not be below 90 percent of rated capacity.

8.10 Test for Voltages During Discharge

The following minimum voltage shall be obtained when the cell is under discharge at 10 h rate. The voltage shall be obtained in the cycle in which the cell or battery meets the rated capacity.

a) At the start of discharge — 10 h after putting on the load — 1·98 V

b) After 6 h from start — 1·92 V

c) After 10 h from start — 1·85 V

9 CONDITIONS OF SUPPLY

9.1 To facilitate correct supply of stationary cells and batteries, it is recommended that the purchaser should furnish information regarding his requirements as given in Annex B, and the supplier should furnish particulars as given in Annex C.

9.2 Other conditions of supply shall be subject to agreement between the purchaser and the supplier.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
266 : 1977	Sulphuric acid (*second revision*)	3116 : 1965	Sealing compound for lead-acid batteries
1069 : 1964	Water for storage batteries (*revised*)		
1146 : 1981	Rubber and plastics containers for lead-acid storage batteries (*second revision*)	6071 : 1986	Synthetic separators for lead-acid batteries (*first revision*)
1885 (Part 8) : 1986	Electrotechnical vocabulary : Part 8 Secondary cells and batteries (*first revision*)	8320 : 1982	General requirements and methods of tests for lead-acid storage batteries (*first revision*)

ANNEX B

(*Clause* 9.1)

INFORMATION TO BE FURNISHED BY THE PURCHASER WITH ENQUIRY OR ORDER

B-1 When enquiring about or ordering for stationary cells and batteries. lead-acid type with pasted plates, the following information should be furnished by the purchaser:

a) Number of identical batteries required;

b) Number of cells per battery;

c) Details, if it is proposed to use any of the cells of a battery at different rates of charge and discharge;

d) Capacity (in ampere-hours at the 10 h rate) and discharge duty of batteries;

e) Cell designation in accordance with this standard;

f) The proposed method of working, that is charge-discharge, float working for stand by with or without trickle charging. In case of float working, the floating voltage and the limits of regulation are to be indicated;

g) Whether stands are required and if so, details of layout or space available;

h) The proposed location of installation and the expected dates of tests to be conducted;

j) Accessories and spares required, if any; and

k) Special conditions, if any.

ANNEX C

(*Clause* 9.1)

PARTICULARS TO BE FURNISHED BY THE SUPPLIER

C-1 When supplying stationary cells or batteries lead-acid type with pasted plates, the following particulars should be furnished by the supplier:

a) Capacity of cell or battery at the 10 h rate;

b) Manufacturer's name;

c) Cell designation in accordance with the standard;

d) Type of plates;

e) Method of connection between cells, that is, whether bolted or burnt;

f) Material of lid and lid terminals, if used;

g) Recommended starting and finishing rates of charge;

h) Voltage per cell at the end of charge;

j) Recommended trickle charging rate;

k) Type and material of the separators;

m) Type and materials of retainers;

n) Material of container;

p) Amount and specific gravity of electrolyte per cell required for first filling;

q) Recommended specific gravity of electrolyte at the end of a full charge;

r) Expected specific gravity of electrolyte at the end of discharge at 10-h rate;

s) Overall dimensions of each cell;

t) Distance between the centres of cells when erected;

u) Weight of cell complete with acid;

v) Recommended maximum storage period before the first charge; and

w) Internal resistance of the cell.

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This Indian Standard has been developed from Doc:

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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